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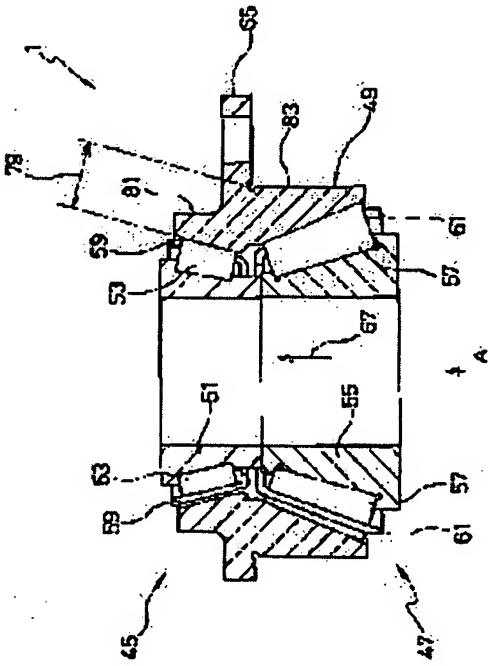
(54) THRUST BEARING MECHANISM

(57)Abstract:
PROBLEM TO BE SOLVED: To improve durability, to reinforce a base part of a flange part, and to provide a compact constitution.
SOLUTION: A pair of thrust bearings 45, 47 are disposed between a rotating shaft receiving engagement reaction force of gear and a casing, while the thrust bearings 45, 47 receive opposite directional force each other. In the thrust bearing 47 disposed in one side where it receives the engagement reaction force, a large rolling element 57 is used according to the engagement reaction force. In the thrust bearing 45 disposed in the other side where it does not receive the engagement reaction force, a small rolling element 53 is used suitably.



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CLAIMS

[Claim(s)]
[Claim 1] It is arranged between the revolving shafts and casing which receive the engagement reaction force of a gear. It consists of the outer race by the side of casing, an inner race by the side of a revolving shaft, and a rolling element arranged among these, respectively. In thrust bearing arranged in the direction which is the thrust-bearing device which consists of thrust bearings of the pair which receives the force of an opposite direction mutually, and receives engagement reaction force The thrust-bearing device characterized by using the large rolling element according to this engagement reaction force, and using the small rolling element in thrust bearing arranged in the direction which does not receive engagement reaction force according to it.
[Claim 2] The thrust-bearing device characterized by being invention according to claim 1 and each thrust bearing being the cone koro bearing which used the conic koro for the rolling element.
[Claim 3] The thrust-bearing device characterized by being invention according to claim 1 and each thrust bearing being the angular contact bearing of the pair which has the contact angle of an opposite direction mutually.
[Claim 4] The thrust-bearing device characterized by being invention according to claim 1 and each thrust bearing being a ball bearing which can receive the thrust force.
[Claim 5] The thrust-bearing device characterized by forming this flange in the thrust-bearing side using a small rolling element while being invention given in any 1 term of claim 1 thru/or claim 4, forming the outer race of both thrust bearings in one and fixing this outer race to a casing side through a flange.
[Claim 6] The thrust-bearing device characterized by being invention given in any 1 term of claim 1 thru/or claim 5, being the drive pinion shaft which a revolving shaft is arranged at a differential case and a right angle, and rotates with engine driving force, and being the bevel gear to which a gear carries out the rotation drive of the differential case while it is formed in this drive pinion shaft and a direction is changed by engagement with the ring-like bevel gear by the side of a differential case.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the thrust-bearing device in which it is used for the transmission of a car.
[0002]
[Description of the Prior Art] Differential equipment 201 like drawing 7 is indicated by JP,5-345535,A.
[0003] In this differential equipment 201, engine driving force is transmitted to the differential mechanism 209 of a planetary-gear type by engagement of bevel gears 205 and 207 from an input shaft 203, is distributed to one axle 213 from the pinion gear carrier 211 of a differential mechanism 209, and is distributed to the axle 217 of another side from a sun gear 215.
[0004] Between this pinion gear carrier 211 and axle 217, the multiple disc clutch 221 which is intermittent in a speed-increasing system 219 and this, the multiple disc clutch 225 which is intermittent in the moderation device 223 and this are arranged.
[0005] If the multiple disc clutch 221 by the side of a speed-increasing system 219 is concluded, a speed-increasing system 219 will accelerate the wheel by the side of an axle 217, and the yaw moment of the anticlockwise rotation direction will arise into a car body. Moreover, if the multiple disc clutch 225 by the side of the moderation device 223 is concluded, according to the moderation device 223, the wheel by the side of an axle 217 will be slowed down, and the yaw moment of the clockwise rotation direction will arise into a car body.
[0006] If the yaw moment of a direction required for a car body is given by such yaw moment control function, the turnability of a car will improve or rectilinear-propagation stability will improve.
[0007] Bearing of the input shaft 203 is carried out to the differential-gear carrier 231 by the thrust-bearing device 227 and the ball bearing 229.
[0008] As shown in drawing 8 and drawing 9 , the thrust-bearing device 227 consists of thrust bearings 233 and 235 of the pair arranged face to face.
[0009] One thrust bearing 233 is cone koro bearing which has arranged the cone koro 241 between an outer race 237 and an inner race 239, and the thrust bearing 235 of another side is cone koro bearing which has arranged the cone koro 241 between an outer race 237 and an inner race 243. Each cone koro 241 is having the location held by the retainer 245.
[0010] Moreover, the outer race 237 is shared among both the thrust bearings 233 and 235, and the flange 249 is fixed to the differential-gear carrier 231 with the bolt 247 like drawing 7 .
[0011] Like drawing 9 , the flange 249 is formed in four places and each flange 249 is formed in the edge of an outer race 237 like drawing 8 .
[0012]
[Problem(s) to be Solved by the Invention] Big driving force is transmitted, the engagement thrust force 251 as each arrow head of drawing 7 and drawing 8 shows by engagement of bevel gears 205 and 207 arises in that case, and an input shaft 203 is applied to the thrust-bearing device 227 through an input shaft 203.
[0013] However, like drawing 8 , this engagement thrust force 251 is applied only to the thrust bearing [on the other hand / (bevel gear 205 side)] 235 of the thrust-bearing device 227, and is not applied to the thrust bearing 233 of another side.
[0014] As mentioned above, since each cone koro 241 of each thrust bearings 233 and 235 is the same and endurance is also equivalent, only in the thrust bearing 235 of the direction which requires a big burden, endurance will fall.
[0015] Moreover, it is not necessary to use a thing equivalent to thrust bearing 235 for the thrust bearing

233 of the direction which does not require a big burden.
[0016] Moreover, like drawing 8 , it is formed in the edge of an outer race 237, and a flange 249 has the thin thickness 253 of a base, and its reinforcement is inadequate.
[0017] Then, this invention is compact as a whole, and the reinforcement of the base of a flange aims [invention] at offer of a large thrust-bearing device while it is excellent in endurance.
[0018]
[Means for Solving the Problem] The thrust-bearing device of claim 1 is arranged between the revolving shafts and casing which receive the engagement reaction force of a gear. It consists of the outer race by the side of casing, an inner race by the side of a revolving shaft, and a rolling element arranged among these, respectively. In thrust bearing arranged in the direction which is the thrust-bearing device which consists of thrust bearings of the pair which receives the force of an opposite direction mutually, and receives engagement reaction force It is characterized by using the large rolling element according to this engagement reaction force, and using the small rolling element in thrust bearing arranged in the direction which does not receive engagement reaction force according to it.
[0019] By the thrust-bearing device of this invention, the large rolling element according to engagement reaction force is used for thrust bearing of the direction which receives engagement reaction force among thrust bearings of the pair which receives the force of an opposite direction unlike the conventional example, and the small rolling element is used for thrust bearing of the direction which does not receive engagement reaction force according to it.
[0020] Thus, the endurance of the whole thrust-bearing device improves sharply by having used the large rolling element for thrust bearing of the direction which receives engagement reaction force.
[0021] Moreover, by having made the rolling element small according to it, it is small and thrust bearing of the direction which does not receive engagement reaction force becomes lightweight.
[0022] In this way, acquiring sufficient endurance, a thrust-bearing device is lightweight to the whole, and is constituted by the compact.
[0023] In addition, the thrust-bearing device of this invention is used for the straight bevel gear which large engagement reaction force produces, spiral bevel gear, hypoid gears, etc., and the big improvement effectiveness in endurance is acquired.
[0024] Invention of claim 2 is a thrust-bearing device according to claim 1, is characterized by each thrust bearing being the cone koro bearing which used the conic koro for the rolling element, and acquires effectiveness equivalent to the configuration of claim 1.
[0025] In addition, since the cone koro receives a load on a line, the cone koro bearing which used the conic koro for the rolling element can bear a big load, and its endurance is high.
[0026] Invention of claim 3 is a thrust-bearing device according to claim 1, is characterized by each thrust bearing being the angular contact bearing of the pair which has the contact angle of an opposite direction mutually, and acquires effectiveness equivalent to the configuration of claim 1.
[0027] Invention of claim 4 is a thrust-bearing device according to claim 1, is characterized by each thrust bearing being a ball bearing which can receive the thrust force, and acquires effectiveness equivalent to the configuration of claim 1.
[0028] In addition, this configuration can be carried out to low cost by having used the usual ball bearing for thrust bearing.
[0029] Invention of claim 5 is a thrust-bearing device given in any 1 term of claim 1 thru/or claim 4, is characterized by forming this flange in the thrust-bearing side using a small rolling element, and acquires effectiveness equivalent to either claim 1 thru/or claim 4 while the outer race of both thrust bearings is formed in one and this outer race is fixed to a casing side through a flange.
[0030] Moreover, in thrust bearing of the direction which does not receive engagement reaction force, the thickness of an outer race becomes thick by making a rolling element small.
[0031] Therefore, with this configuration that forms the flange of an outer race in the small thrust-bearing side of a rolling element, the thickness of the base of a flange becomes thick and reinforcement improves sharply.
[0032] Invention of claim 6 is a thrust-bearing device given in any 1 term of claim 1 thru/or claim 5. It is the drive pinion shaft which a revolving shaft is arranged at a differential case and a right angle, and rotates with engine driving force, and a gear is formed in this drive pinion shaft. By engagement with the ring-like bevel gear by the side of a differential case It is characterized by being the bevel gear which carries out the rotation drive of the differential case, changing a direction, and effectiveness equivalent to either claim 1 thru/or claim 5 is acquired.
[0033] Since the big engagement thrust force is applied to the drive pinion shaft which is arranged at a differential case and a right angle and transmits engine driving force from the directional change gear group which consisted of bevel gears, the improvement effectiveness of endurance by having used the

large rolling element for thrust bearing of the direction which receives engagement reaction force is very large.
[0034] Moreover, it is advantageous to have made the rolling element small by thrust bearing of the direction which does not receive engagement reaction force, and to have made the thrust-bearing device into the small light weight, especially when it is compact and the transmission of a car is constituted lightweight.
[0035] Furthermore, that the flange of an outer race was strengthened has a drive pinion shaft advantageous at especially the transmission that receives vibration of a car body, treating big driving force.
[0036]
[Embodiment of the Invention] Drawing 1 thru/or drawing 4 explain the 1st operation gestalt of this invention. Drawing 1 shows the rear differential gear 3 which used the thrust-bearing device 1 of this operation gestalt, and this thrust-bearing device 1 is equipped with the description of claims 1, 2, 5, and 6. Moreover, the direction of on either side is the direction of right and left by the car and drawing 1 which used the rear differential gear 3, and drawing 2 , and the upper part of drawing 1 and drawing 2 corresponds ahead of this car. In addition, the member which has not given the sign is not illustrated.
[0037] The rear differential gear 3 is used for the rear drive vehicle (FR vehicle) which has arranged the engine to the anterior part of a car body.
[0038] The rear differential gear 3 consists of an actuator which presses the thrust-bearing device 1, the drive pinion shaft 5 (revolving shaft), the drive pinion gear 7 (bevel gear), a ring wheel 9 (bevel gear), a differential case 11, the differential mechanism 13 of a bevel gear type, a speed-increasing system, the multiple disc clutch that is intermittent in the torque transmission of this speed-increasing system, a moderation device, the multiple disc clutches which are intermittent in the torque transmission of this moderation device, and these multiple disc clutches, respectively, a controller which operates each actuator.
[0039] As shown in drawing 1 , the rear differential gear 3 is contained inside the differential-gear carrier 15 (casing). Bearing of the differential case 11 of the rear differential gear 3 is carried out to the differential-gear carrier 15 by bearing 17, respectively.
[0040] The drive pinion shaft 5 is arranged at the differential case 11 and the right angle, and the ball bearing 19 carries out bearing of the posterior part to the differential-gear carrier 15 according to the thrust-bearing device 1 in anterior part again, respectively.
[0041] Moreover, the drive pinion shaft 5 has penetrated the differential-gear carrier 15 outside, and spline connection of the flange 21 is carried out at the front end, and it is being fixed with the nut 23. It connects with the driveshaft side through the flange 21, the seal 25 has been arranged between the differential-gear carrier 15 and a flange 21, and the drive pinion shaft 5 has prevented the oil leak by the exterior.
[0042] In this way, engine driving force rotates a differential case 11 through a driveshaft from transmission.
[0043] A ring wheel 9 gears with the drive pinion gear 7 mutually, and constitutes the directional change gear group. The drive pinion gear 7 is really formed in the back end of the drive pinion shaft 5, and the ring wheel 9 is being fixed to the differential case 11 with the bolt 27.
[0044] The differential mechanism 13 of a bevel gear type consists of side gears 33 and 35 of the right and left which gear with the pinion shaft 29 fixed to the differential case 11, the pinion gear 31 by which bearing was carried out on the pinion shaft 29, and a pinion gear 31 etc. The left side gear 33 is connected with the left rear wheel through a left drive shaft, a left splice, etc., and the right side gear 35 is connected with the right rear wheel through a right drive shaft 37, a right splice, etc.
[0045] The driving force of the engine made to rotate a differential case 11 is distributed to side gears 33 and 35 through a pinion gear 31 from a pinion shaft 29, and is transmitted to a rear wheel on either side through a drive shaft etc., respectively. Moreover, if a drive resistance difference arises between rear wheels on a bad road etc., the differential distribution of the engine driving force will be carried out by rotation of a pinion gear 31 at a rear wheel side on either side.
[0046] The gear 39 is being fixed to the differential case 11, and gears 41 and 43 are being fixed to the right drive shaft 37.
[0047] Moreover, the counter shaft is arranged at a differential case and parallel, and the gear of three sheets which gears with gears 39, 41, and 43, respectively is being fixed to this counter shaft.
[0048] The speed-increasing system consists of each gear on the counter shaft which gears with a gear 39, a gear 41, and these, and the moderation device consists of each gear on the counter shaft which gears with a gear 39, a gear 43, and these.
[0049] Each actuator operates with the oil pressure sent from the oil pump of an engine drive, presses

each multiple disc clutch the object for speed-increasing systems, and for moderation devices, respectively, and concludes it.
[0050] A controller controls the conclusion force of the concluded multiple disc clutch while it is intermittent to each ** in these multiple disc clutches through an actuator according to the steering conditions of a car, transit conditions, a road surface condition, etc.
[0051] If the multiple disc clutch for speed-increasing systems is concluded and conclusion of the multiple disc clutch for moderation devices is canceled, the driving torque only for the accelerating will move to a left drive shaft through a differential mechanism 11, and the driving torque of a differential case 11 (gear 39) will slow down a left rear ring while accelerating it by the speed-increasing system and accelerating a right rear ring through a drive shaft 37.
[0052] In this way, the yaw moment of the anticlockwise rotation direction is given to a car body.
[0053] Moreover, when the multiple disc clutch for moderation devices is concluded and conclusion of the multiple disc clutch for speed-increasing systems is canceled, a right rear ring is slowed down and a moderation device accelerates a left rear ring.
[0054] In this way, the yaw moment of the clockwise rotation direction is given to a car body.
[0055] By such yaw moment control function, when a car rotates clockwise, the yaw moment of the clockwise rotation direction is given to a car body, and at the time of anticlockwise rotation, if the yaw moment of the anticlockwise rotation direction is given, the turnability of a car will improve greatly.
[0056] Moreover, if each multiple disc clutch is switched and operated and the yaw moment of meandering and an opposite direction is similarly given to a car body when a car body moves in a zigzag direction on a bad road etc., meandering can be converged and rectilinear-propagation nature and stability can be raised.
[0057] Moreover, the change gear ratio of a speed-increasing system and a moderation device changes by controlling the conclusion force of a multiple disc clutch and letting these slide moderately, and since it is possible to adjust the yaw moment, according to change of the terms and conditions under transit, the turnability of a car body, rectilinear-propagation nature, stability, etc. are controllable to a precision.
[0058] Like drawing 2 , the thrust-bearing device 1 consists of thrust bearings 45 and 47 of the pair countered and arranged forward and backward.
[0059] The thrust bearing 45 by the side of before is cone koro bearing which has arranged the small cone koro 53 (rolling element) between an outer race 49 and an inner race 51, and the thrust bearing 47 on the backside (drive pinion gear 7 side) is cone koro bearing which has arranged the large-sized cone koro 57 (rolling element) between an outer race 49 and an inner race 55. These cone koro 53 and 57 is having the location held by retainers 59 and 61, respectively.
[0060] Moreover, the outer race 49 is shared among both the thrust bearings 45 and 47, and the outer race 49 is being fixed to the differential-gear carrier 15 in the flange 65 with the bolt 63 like drawing 1 .
[0061] Like drawing 3 , the flange 65 is formed in four places of a periphery, and each flange 65 is formed in the thrust-bearing 45 side of an outer race 49 like drawing 2 .
[0062] In the drive pinion shaft 5, the engagement thrust force 67 as each arrow head of drawing 1 and drawing 2 shows arises by engagement with the drive pinion gear 7 and ring wheel 9 which are a bevel gear.
[0063] Since this engagement thrust force 67 is applied to the drive pinion gear 7 side thrust bearing 47 of the thrust-bearing device 1, the large-sized thing [koro / 57 / of thrust bearing 47 / cone] according to the engagement thrust force 67 is used like drawing 2 .
[0064] Thus, compared with the thrust-bearing device 227 of the conventional example using the same thrust bearings 233 and 235, the whole endurance of the thrust-bearing device 1 is improving sharply by one pair by having used the large cone koro 57 for the thrust bearing 47 of the direction which receives the engagement thrust force 67.
[0065] Moreover, in the thrust bearing 45 of the opposite side which does not require the engagement thrust force 67, the thing sharply smaller than the cone koro 57 is used for the cone koro 53. Furthermore, this cone koro 53 is smaller than the cone koro 241 used for the conventional example.
[0066] Thus, since the thrust bearing 45 of the direction which does not receive the engagement thrust force 67 made the cone koro 51 small according to it, it is small and lightweight.
[0067] Drawing 4 shows the outer race 237 in the conventional example. A continuous line 69 is the inner circumference of the outer race 237 by the cone koro 241, a broken line 71 is the inner circumference of the outer race 237 when making the cone koro into a major diameter, and a broken line 73 is the inner circumference of the outer race 237 when making the cone koro into a minor diameter.
[0068] Thus, if the cone koro is made into a minor diameter, a flange 249 can make thickness 75 of a base thicker than the thickness 77 when making the cone koro into a major diameter.
[0069] So, in thrust bearing 45, since the small cone koro 53 is used, as mentioned above, by having

formed the flange 65 of an outer race 49 in this thrust-bearing 45 side, sufficient thickness 79 is obtained and reinforcement of the base of a flange 65 is improving sharply.
[0070] Furthermore, since sufficient thickness 79 is obtained, by minor-diameter-izing more sharply than the periphery 83 by the side of thrust bearing 47 the periphery 81 by the side of thrust bearing 45, it is so small and the outer race 49 is lightweight.
[0071] In this way, the thrust-bearing device 1 is constituted.
[0072] As mentioned above, the whole endurance of the thrust-bearing device 1 is improving sharply by having used the large cone koro 57 for the thrust bearing 47 of the direction which receives the engagement thrust force 67.
[0073] Moreover, by having made the cone koro 53 small according to it, it is small and the thrust bearing 45 of the direction which does not receive engagement reaction force becomes lightweight.
[0074] Therefore, acquiring sufficient endurance, the thrust-bearing device 1 is lightweight and is constituted by the compact.
[0075] Moreover, by having formed in the small thrust-bearing 45 side, sufficient thickness 79 for a base was obtained and the flange 65 of an outer race 49 has obtained big reinforcement.
[0076] Moreover, since the cone koro 53 and 57 of a rolling element receives a load on a line, the thrust-bearing device 1 using the thrust bearings 45 and 47 of cone koro bearing can bear the big engagement thrust force 67, and is so high. [of endurance]
[0077] Moreover, since the big engagement thrust force 67 is applied to the drive pinion shaft 5 of the rear differential gear 3 from the directional change gear group of a bevel gear, transmitting engine driving force, the improvement effectiveness of the endurance by having made large-sized the cone koro 57 of thrust bearing 47 is very large.
[0078] Moreover, it is advantageous to have made into the small light weight thrust bearing 45 of the direction which does not receive engagement reaction force, especially when it is compact and the transmission of a car like the rear differential gear 3 is constituted lightweight.
[0079] Furthermore, that the flange 65 of an outer race 49 was strengthened has the advantageous drive pinion shaft 5 at especially the rear differential gear 3 that treats big driving force upwards and receives vibration of a car body.
[0080] Moreover, when the improvement effectiveness in endurance that they are big when the drive pinion shaft 5 and the drive pinion gear 7 consist of hypoid gears or spiral bevel gear is acquired and the thrust-bearing device 1 consists of straight bevel gear, the still bigger improvement effectiveness in endurance is acquired.
[0081] Next, drawing 5 explains the 2nd operation gestalt of this invention. The thrust-bearing device 85 of this operation gestalt is equipped with the description of claims 1, 3, 5, and 6, and is used for the rear differential gear 3 like the thrust-bearing device 1. Moreover, the upper part of drawing 5 corresponds ahead of the car which used the rear differential gear 3. In addition, the member which has not given the sign is not illustrated.
[0082] Like drawing 5 , the thrust-bearing device 85 consists of angular contact bearings 87 and 89 (thrust bearing) of the pair countered and arranged forward and backward, and these are arranged so that a mutual contact angle may become an opposite direction.
[0083] The angular contact bearing 87 by the side of before consists of retainers holding the location of an outer race 91, an inner race 93, the ball 95 (rolling element) of the minor diameter arranged among these, and each ball 95.
[0084] Moreover, the angular contact bearing 89 on the backside (drive pinion gear 7 side) consists of retainers holding the location of an outer race 91, an inner race 97, the ball 99 (rolling element) of the major diameter arranged among these, and each ball 99.
[0085] Fitting of each inner races 93 and 97 is carried out to the drive pinion shaft 5. Moreover, the outer race 91 is shared among both the angular contact bearings 87 and 89, and the flange 101 is fixed to the differential-gear carrier 15 with the bolt 63.
[0086] The flange 101 is formed in four places of a periphery, and each flange 101 is formed in the angular contact bearing 87 side of an outer race 91 like drawing 5 .
[0087] Since the engagement thrust force 67 produced in the drive pinion shaft 5 by engagement with the drive pinion gear 7 and a ring wheel 9 is applied to the angular contact bearing 89 by the side of the drive pinion gear 7, as for the ball 99, the large-sized thing is used according to the engagement thrust force 67.
[0088] Thus, since the large ball 99 was used for the angular contact bearing 89 of the direction which receives the engagement thrust force 67, compared with the conventional example, the whole endurance of the thrust-bearing device 85 is improving sharply.
[0089] Moreover, the ball 95 of a minor diameter is used for the angular contact bearing 87 of the

opposite side which does not require the engagement thrust force 67 from the ball 99.
[0090] Thus, since the angular contact bearing 87 which does not receive the engagement thrust force 67 made the ball 95 the minor diameter according to it, it is small and lightweight.
[0091] Moreover, since the flange 101 of an outer race 91 was formed in the angular contact bearing 87 side using the ball 95 of a minor diameter, sufficient thickness 103 for a base is obtained and reinforcement of a flange 101 is improving sharply.
[0092] Furthermore, since sufficient thickness 103 is obtained, by minor-diameter-izing more sharply than the periphery 107 by the side of the angular contact bearing 89 the periphery 105 by the side of the angular contact bearing 87, it is so small and the outer race 91 is lightweight.
[0093] In this way, the thrust-bearing device 85 is constituted.
[0094] As mentioned above, the whole endurance of the thrust-bearing device 85 is improving sharply by having used the ball 99 of a major diameter for the angular contact bearing 89 of the direction which receives the engagement thrust force 67.
[0095] Moreover, by having made the ball 95 small according to it, it is small and the angular contact bearing 87 of the direction which does not receive engagement reaction force becomes lightweight.
[0096] Therefore, acquiring sufficient endurance, the thrust-bearing device 85 is lightweight and is constituted by the compact.
[0097] Moreover, by having formed in the small angular contact bearing 87 side, sufficient thickness 103 for a base was obtained and the flange 101 of an outer race 91 has obtained big reinforcement.
[0098] In addition, the thrust-bearing device 85 acquires effectiveness equivalent to the thrust-bearing device 1 by having used for the rear differential gear 3.
[0099] Next, drawing 6 explains the 3rd operation gestalt of this invention. The thrust-bearing device 109 of this operation gestalt is equipped with the description of claims 1, 4, 5, and 6, and is used for the rear differential gear 3 like the thrust-bearing devices 1 and 85. Moreover, the upper part of drawing 6 corresponds ahead of the car which used the rear differential gear 3. In addition, the member which has not given the sign is not illustrated.
[0100] Like drawing 6 , the thrust-bearing device 109 consists of deep groove mold ball bearings 111 and 113 (thrust bearing) of the pair countered and arranged forward and backward.
[0101] The ball bearing 111 by the side of before consists of retainers holding the location of an outer race 115, an inner race 117, the ball 119 (rolling element) of the minor diameter arranged among these, and each ball 119.
[0102] Moreover, the ball bearing 113 on the backside (drive pinion gear 7 side) consists of retainers holding the location of an outer race 115, an inner race 121, the ball 123 (rolling element) of the major diameter arranged among these, and each ball 123.
[0103] Fitting of each inner races 117 and 121 is carried out to the drive pinion shaft 5. Moreover, the outer race 115 is shared among both the ball bearings 111 and 113, and the flange 125 is fixed to the differential-gear carrier 15 with the bolt 63.
[0104] The flange 125 is formed in four places of a periphery, and each flange 125 is formed in the ball bearing 111 side of an outer race 115 like drawing 6 .
[0105] Since the engagement thrust force 67 produced in the drive pinion shaft 5 by engagement with the drive pinion gear 7 and a ring wheel 9 is applied to the ball bearing 113 by the side of the drive pinion gear 7, as for the ball 123, the large-sized thing is used according to the engagement thrust force 67.
[0106] Thus, since the large ball 123 was used for the ball bearing 113 of the direction which receives the engagement thrust force 67, compared with the conventional example, the whole endurance of the thrust-bearing device 109 is improving sharply.
[0107] Moreover, in the ball bearing 111 of the opposite side which does not require the engagement thrust force 67, the ball 119 of a minor diameter is used from the ball 123.
[0108] Thus, since the ball bearing 111 of the direction which does not receive the engagement thrust force 67 made the ball 119 the minor diameter according to it, it is small and lightweight.
[0109] Moreover, since the flange 125 of an outer race 115 was formed in the ball bearing 111 side using the ball 119 of a minor diameter, sufficient thickness 127 for a base is obtained and reinforcement of a flange 125 is improving sharply.
[0110] Furthermore, since sufficient thickness 127 is obtained, by minor-diameter-izing more sharply than the periphery 131 by the side of a ball bearing 113 the periphery 129 by the side of a ball bearing 111, it is so small and the outer race 115 is lightweight.
[0111] In this way, the thrust-bearing device 109 is constituted.
[0112] As mentioned above, the whole endurance of the thrust-bearing device 109 is improving sharply by having used the ball 123 of a major diameter for the ball bearing 113 of the direction which receives the engagement thrust force 67.

[0113] Moreover, by having made the ball 119 small according to it, it is small and the ball bearing 111 of the direction which does not receive engagement reaction force becomes lightweight.
[0114] Therefore, acquiring sufficient endurance, the thrust-bearing device 109 is lightweight and is constituted by the compact.
[0115] Moreover, by having formed in the small ball bearing 111 side, sufficient thickness 127 for a base was obtained and the flange 125 of an outer race 115 has obtained big reinforcement.
[0116] Moreover, since the ball bearings 111 and 113 of a deep groove mold can bear thrust loading enough, they can carry out the thrust-bearing device 109 to low cost by having used such usual ball bearings 111 and 113.
[0117] In addition, the thrust-bearing device 109 acquires effectiveness equivalent to the thrust-bearing devices 1 and 85 by having used for the rear differential gear 3.
[0118]
[Effect of the Invention] Acquiring sufficient endurance, since thrust bearing of the direction which does not receive engagement reaction force is small and becomes lightweight, while the whole endurance improves sharply by having used the small rolling element for thrust bearing of the direction which receives engagement reaction force by the thrust-bearing device of this invention at thrust bearing of an opposite direction using the large rolling element, it is lightweight and is constituted by the compact.
[0119] While invention of claim 2 acquires effectiveness equivalent to the configuration of claim 1, the cone koro bearing which used the conic koro for the rolling element can bear a big load, and its endurance is high.
[0120] Invention of claim 3 acquires effectiveness equivalent to the configuration of claim 1.
[0121] Invention of claim 4 can be carried out to low cost by having used the usual ball bearing for thrust bearing while it acquires effectiveness equivalent to the configuration of claim 1.
[0122] While invention of claim 5 acquires effectiveness equivalent to either claim 1 thru/or claim 4, by forming the flange of an outer race in the small thrust-bearing side of a rolling element, the thickness of a base becomes thick and reinforcement of a flange improves sharply.
[0123] Its improvement effectiveness of the endurance by having used the large rolling element for thrust bearing of the direction which receives engagement reaction force with this configuration that uses a thrust-bearing device for the drive pinion shaft which receives the big engagement reaction force from a directional change gear group while transmitting engine driving force is very large while invention of claim 6 acquires equivalent effectiveness with either claim 1 thru/or claim 5.
[0124] Moreover, it is advantageous to have made small the rolling element of thrust bearing which does not receive engagement reaction force, and to have made it the small light weight, especially when it is compact and the transmission for cars is constituted lightweight.
[0125] Furthermore, it is advantageous that the flange of an outer race was strengthened at especially the transmission that receives driving force with a big drive pinion shaft, and vibration of a car body.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the thrust-bearing device in which it is used for the transmission of a car.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Differential equipment 201 like drawing 7 is indicated by JP,5-345535,A.
[0003] In this differential equipment 201, engine driving force is transmitted to the differential mechanism 209 of a planetary-gear type by engagement of bevel gears 205 and 207 from an input shaft 203, is distributed to one axle 213 from the pinion gear carrier 211 of a differential mechanism 209, and is distributed to the axle 217 of another side from a sun gear 215.
[0004] Between this pinion gear carrier 211 and axle 217, the multiple disc clutch 221 which is intermittent in a speed-increasing system 219 and this, the multiple disc clutch 225 which is intermittent in the moderation device 223 and this are arranged.
[0005] If the multiple disc clutch 221 by the side of a speed-increasing system 219 is concluded, a speed-increasing system 219 will accelerate the wheel by the side of an axle 217, and the yaw moment of the anticlockwise rotation direction will arise into a car body. Moreover, if the multiple disc clutch 225 by the side of the moderation device 223 is concluded, according to the moderation device 223, the wheel by the side of an axle 217 will be slowed down, and the yaw moment of the clockwise rotation direction will arise into a car body.
[0006] If the yaw moment of a direction required for a car body is given by such yaw moment control function, the turnability of a car will improve or rectilinear-propagation stability will improve.
[0007] Bearing of the input shaft 203 is carried out to the differential-gear carrier 231 by the thrust-bearing device 227 and the ball bearing 229.
[0008] As shown in drawing 8 and drawing 9 , the thrust-bearing device 227 consists of thrust bearings 233 and 235 of the pair arranged face to face.
[0009] One thrust bearing 233 is cone koro bearing which has arranged the cone koro 241 between an outer race 237 and an inner race 239, and the thrust bearing 235 of another side is cone koro bearing which has arranged the cone koro 241 between an outer race 237 and an inner race 243. Each cone koro 241 is having the location held by the retainer 245.
[0010] Moreover, the outer race 237 is shared among both the thrust bearings 233 and 235, and the flange 249 is fixed to the differential-gear carrier 231 with the bolt 247 like drawing 7 .
[0011] Like drawing 9 , the flange 249 is formed in four places and each flange 249 is formed in the edge of an outer race 237 like drawing 8 .

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Acquiring sufficient endurance, since thrust bearing of the direction which does not receive engagement reaction force is small and becomes lightweight, while the whole endurance improves sharply by having used the small rolling element for thrust bearing of the direction which receives engagement reaction force by the thrust-bearing device of this invention at thrust bearing of an opposite direction using the large rolling element, it is lightweight and is constituted by the compact.
[0119] While invention of claim 2 acquires effectiveness equivalent to the configuration of claim 1, the cone koro bearing which used the conic koro for the rolling element can bear a big load, and its endurance is high.
[0120] Invention of claim 3 acquires effectiveness equivalent to the configuration of claim 1.
[0121] Invention of claim 4 can be carried out to low cost by having used the usual ball bearing for thrust bearing while it acquires effectiveness equivalent to the configuration of claim 1.
[0122] While invention of claim 5 acquires effectiveness equivalent to either claim 1 thru/or claim 4, by forming the flange of an outer race in the small thrust-bearing side of a rolling element, the thickness of a base becomes thick and reinforcement of a flange improves sharply.
[0123] Its improvement effectiveness of the endurance by having used the large rolling element for thrust bearing of the direction which receives engagement reaction force with this configuration that uses a thrust-bearing device for the drive pinion shaft which receives the big engagement reaction force from a directional change gear group while transmitting engine driving force is very large while invention of claim 6 acquires equivalent effectiveness with either claim 1 thru/or claim 5.
[0124] Moreover, it is advantageous to have made small the rolling element of thrust bearing which does not receive engagement reaction force, and to have made it the small light weight, especially when it is compact and the transmission for cars is constituted lightweight.
[0125] Furthermore, it is advantageous that the flange of an outer race was strengthened at especially the transmission that receives driving force with a big drive pinion shaft, and vibration of a car body.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Big driving force is transmitted, the engagement thrust force 251 as each arrow head of drawing 7 and drawing 8 shows by engagement of bevel gears 205 and 207 arises in that case, and an input shaft 203 is applied to the thrust-bearing device 227 through an input shaft 203.
[0013] However, like drawing 8 , this engagement thrust force 251 is applied only to the thrust bearing [on the other hand / (bevel gear 205 side)] 235 of the thrust-bearing device 227, and is not applied to the thrust bearing 233 of another side.
[0014] As mentioned above, since each cone koro 241 of each thrust bearings 233 and 235 is the same and endurance is also equivalent, only in the thrust bearing 235 of the direction which requires a big burden, endurance will fall.
[0015] Moreover, it is not necessary to use a thing equivalent to thrust bearing 235 for the thrust bearing 233 of the direction which does not require a big burden.
[0016] Moreover, like drawing 8 , it is formed in the edge of an outer race 237, and a flange 249 has the thin thickness 253 of a base, and its reinforcement is inadequate.
[0017] Then, this invention is compact as a whole, and the reinforcement of the base of a flange aims [invention] at offer of a large thrust-bearing device while it is excellent in endurance.

[Translation done.]

MEANS

[Means for Solving the Problem] The thrust-bearing device of claim 1 is arranged between the revolving shafts and casing which receive the engagement reaction force of a gear. It consists of the outer race by the side of casing, an inner race by the side of a revolving shaft, and a rolling element arranged among these, respectively. In thrust bearing arranged in the direction which is the thrust-bearing device which consists of thrust bearings of the pair which receives the force of an opposite direction mutually, and receives engagement reaction force It is characterized by using the large rolling element according to this engagement reaction force, and using the small rolling element in thrust bearing arranged in the direction which does not receive engagement reaction force according to it.
[0019] By the thrust-bearing device of this invention, the large rolling element according to engagement reaction force is used for thrust bearing of the direction which receives engagement reaction force among thrust bearings of the pair which receives the force of an opposite direction unlike the conventional example, and the small rolling element is used for thrust bearing of the direction which does not receive engagement reaction force according to it.
[0020] Thus, the endurance of the whole thrust-bearing device improves sharply by having used the large rolling element for thrust bearing of the direction which receives engagement reaction force.
[0021] Moreover, by having made the rolling element small according to it, it is small and thrust bearing of the direction which does not receive engagement reaction force becomes lightweight.
[0022] In this way, acquiring sufficient endurance, a thrust-bearing device is lightweight to the whole, and is constituted by the compact.
[0023] In addition, the thrust-bearing device of this invention is used for the straight bevel gear which large engagement reaction force produces, spiral bevel gear, hypoid gears, etc., and the big improvement effectiveness in endurance is acquired.
[0024] Invention of claim 2 is a thrust-bearing device according to claim 1, is characterized by each thrust bearing being the cone koro bearing which used the conic koro for the rolling element, and acquires effectiveness equivalent to the configuration of claim 1.
[0025] In addition, since the cone koro receives a load on a line, the cone koro bearing which used the conic koro for the rolling element can bear a big load, and its endurance is high.
[0026] Invention of claim 3 is a thrust-bearing device according to claim 1, is characterized by each thrust bearing being the angular contact bearing of the pair which has the contact angle of an opposite direction mutually, and acquires effectiveness equivalent to the configuration of claim 1.
[0027] Invention of claim 4 is a thrust-bearing device according to claim 1, is characterized by each thrust bearing being a ball bearing which can receive the thrust force, and acquires effectiveness equivalent to the configuration of claim 1.
[0028] In addition, this configuration can be carried out to low cost by having used the usual ball bearing for thrust bearing.
[0029] Invention of claim 5 is a thrust-bearing device given in any 1 term of claim 1 thru/or claim 4, is characterized by forming this flange in the thrust-bearing side using a small rolling element, and acquires effectiveness equivalent to either claim 1 thru/or claim 4 while the outer race of both thrust bearings is formed in one and this outer race is fixed to a casing side through a flange.
[0030] Moreover, in thrust bearing of the direction which does not receive engagement reaction force, the thickness of an outer race becomes thick by making a rolling element small.
[0031] Therefore, with this configuration that forms the flange of an outer race in the small thrust-bearing side of a rolling element, the thickness of the base of a flange becomes thick and reinforcement improves sharply.
[0032] Invention of claim 6 is a thrust-bearing device given in any 1 term of claim 1 thru/or claim 5. It is

the drive pinion shaft which a revolving shaft is arranged at a differential case and a right angle, and rotates with engine driving force, and a gear is formed in this drive pinion shaft. By engagement with the ring-like bevel gear by the side of a differential case It is characterized by being the bevel gear which carries out the rotation drive of the differential case, changing a direction, and effectiveness equivalent to either claim 1 thru/or claim 5 is acquired.

[0033] Since the big engagement thrust force is applied to the drive pinion shaft which is arranged at a differential case and a right angle and transmits engine driving force from the directional change gear group which consisted of bevel gears, the improvement effectiveness of endurance by having used the large rolling element for thrust bearing of the direction which receives engagement reaction force is very large.

[0034] Moreover, it is advantageous to have made the rolling element small by thrust bearing of the direction which does not receive engagement reaction force, and to have made the thrust-bearing device into the small light weight, especially when it is compact and the transmission of a car is constituted lightweight.

[0035] Furthermore, that the flange of an outer race was strengthened has a drive pinion shaft advantageous at especially the transmission that receives vibration of a car body, treating big driving force.

[0036]

[Embodiment of the Invention] Drawing 1 thru/or drawing 4 explain the 1st operation gestalt of this invention. Drawing 1 shows the rear differential gear 3 which used the thrust-bearing device 1 of this operation gestalt, and this thrust-bearing device 1 is equipped with the description of claims 1, 2, 5, and 6. Moreover, the direction of on either side is the direction of right and left by the car and drawing 1 which used the rear differential gear 3, and drawing 2 , and the upper part of drawing 1 and drawing 2 corresponds ahead of this car. In addition, the member which has not given the sign is not illustrated.

[0037] The rear differential gear 3 is used for the rear drive vehicle (FR vehicle) which has arranged the engine to the anterior part of a car body.

[0038] The rear differential gear 3 consists of an actuator which presses the thrust-bearing device 1, the drive pinion shaft 5 (revolving shaft), the drive pinion gear 7 (bevel gear), a ring wheel 9 (bevel gear), a differential case 11, the differential mechanism 13 of a bevel gear type, a speed-increasing system, the multiple disc clutch that is intermittent in the torque transmission of this speed-increasing system, a moderation device, the multiple disc clutches which are intermittent in the torque transmission of this moderation device, and these multiple disc clutches, respectively, a controller which operates each actuator.

[0039] As shown in drawing 1 , the rear differential gear 3 is contained inside the differential-gear carrier 15 (casing). Bearing of the differential case 11 of the rear differential gear 3 is carried out to the differential-gear carrier 15 by bearing 17, respectively.

[0040] The drive pinion shaft 5 is arranged at the differential case 11 and the right angle, and the ball bearing 19 carries out bearing of the posterior part to the differential-gear carrier 15 according to the thrust-bearing device 1 in anterior part again, respectively.

[0041] Moreover, the drive pinion shaft 5 has penetrated the differential-gear carrier 15 outside, and spline connection of the flange 21 is carried out at the front end, and it is being fixed with the nut 23. It connects with the driveshaft side through the flange 21, the seal 25 has been arranged between the differential-gear carrier 15 and a flange 21, and the drive pinion shaft 5 has prevented the oil leak by the exterior.

[0042] In this way, engine driving force rotates a differential case 11 through a driveshaft from transmission.

[0043] A ring wheel 9 gears with the drive pinion gear 7 mutually, and constitutes the directional change gear group. The drive pinion gear 7 is really formed in the back end of the drive pinion shaft 5, and the ring wheel 9 is being fixed to the differential case 11 with the bolt 27.

[0044] The differential mechanism 13 of a bevel gear type consists of side gears 33 and 35 of the right and left which gear with the pinion shaft 29 fixed to the differential case 11, the pinion gear 31 by which bearing was carried out on the pinion shaft 29, and a pinion gear 31 etc. The left side gear 33 is connected with Hidari's rear wheel through a left drive shaft, a left splice, etc., and the right side gear 35 is connected with the right rear wheel through a right drive shaft 37, a right splice, etc.

[0045] The driving force of the engine made to rotate a differential case 11 is distributed to side gears 33 and 35 through a pinion gear 31 from a pinion shaft 29, and is transmitted to a rear wheel on either side through a drive shaft etc., respectively. Moreover, if a drive resistance difference arises between rear wheels on a bad road etc., the differential distribution of the engine driving force will be carried out by rotation of a pinion gear 31 at a rear wheel side on either side.

[0046] The gear 39 is being fixed to the differential case 11, and gears 41 and 43 are being fixed to the right drive shaft 37.
[0047] Moreover, the counter shaft is arranged at a differential case and parallel, and the gear of three sheets which gears with gears 39, 41, and 43, respectively is being fixed to this counter shaft.
[0048] The speed-increasing system consists of each gear on the counter shaft which gears with a gear 39, a gear 41, and these, and the moderation device consists of each gear on the counter shaft which gears with a gear 39, a gear 43, and these.
[0049] Each actuator operates with the oil pressure sent from the oil pump of an engine drive, presses each multiple disc clutch the object for speed-increasing systems, and for moderation devices, respectively, and concludes it.
[0050] A controller controls the conclusion force of the concluded multiple disc clutch while it is intermittent to each ** in these multiple disc clutches through an actuator according to the steering conditions of a car, transit conditions, a road surface condition, etc.
[0051] If the multiple disc clutch for speed-increasing systems is concluded and conclusion of the multiple disc clutch for moderation devices is canceled, the driving torque only for the accelerating will move to Hidari's drive shaft through a differential mechanism 11, and the driving torque of a differential case 11 (gear 39) will slow down a left rear ring while accelerating it by the speed-increasing system and accelerating a right rear ring through a drive shaft 37.
[0052] In this way, the yaw moment of the anticlockwise rotation direction is given to a car body.
[0053] Moreover, when the multiple disc clutch for moderation devices is concluded and conclusion of the multiple disc clutch for speed-increasing systems is canceled, a right rear ring is slowed down and a moderation device accelerates a left rear ring.
[0054] In this way, the yaw moment of the clockwise rotation direction is given to a car body.
[0055] By such yaw moment control function, when a car rotates clockwise, the yaw moment of the clockwise rotation direction is given to a car body, and at the time of anticlockwise rotation, if the yaw moment of the anticlockwise rotation direction is given, the turnability of a car will improve greatly.
[0056] Moreover, if each multiple disc clutch is switched and operated and the yaw moment of meandering and an opposite direction is similarly given to a car body when a car body moves in a zigzag direction on a bad road etc., meandering can be converged and rectilinear-propagation nature and stability can be raised.
[0057] Moreover, the change gear ratio of a speed-increasing system and a moderation device changes by controlling the conclusion force of a multiple disc clutch and letting these slide moderately, and since it is possible to adjust the yaw moment, according to change of the terms and conditions under transit, the turnability of a car body, rectilinear-propagation nature, stability, etc. are controllable to a precision.
[0058] Like drawing 2 , the thrust-bearing device 1 consists of thrust bearings 45 and 47 of the pair countered and arranged forward and backward.
[0059] The thrust bearing 45 by the side of before is cone koro bearing which has arranged the small cone koro 53 (rolling element) between an outer race 49 and an inner race 51, and the thrust bearing 47 on the backside (drive pinion gear 7 side) is cone koro bearing which has arranged the large-sized cone koro 57 (rolling element) between an outer race 49 and an inner race 55. These cone koro 53 and 57 is having the location held by retainers 59 and 61, respectively.
[0060] Moreover, the outer race 49 is shared among both the thrust bearings 45 and 47, and the outer race 49 is being fixed to the differential-gear carrier 15 in the flange 65 with the bolt 63 like drawing 1 .
[0061] Like drawing 3 , the flange 65 is formed in four places of a periphery, and each flange 65 is formed in the thrust-bearing 45 side of an outer race 49 like drawing 2 .
[0062] In the drive pinion shaft 5, the engagement thrust force 67 as each arrow head of drawing 1 and drawing 2 shows arises by engagement with the drive pinion gear 7 and ring wheel 9 which are a bevel gear.
[0063] Since this engagement thrust force 67 is applied to the drive pinion gear 7 side thrust bearing 47 of the thrust-bearing device 1, the large-sized thing [koro / 57 / of thrust bearing 47 / cone] according to the engagement thrust force 67 is used like drawing 2 .
[0064] Thus, compared with the thrust-bearing device 227 of the conventional example using the same thrust bearings 233 and 235, the whole endurance of the thrust-bearing device 1 is improving sharply by one pair by having used the large cone koro 57 for the thrust bearing 47 of the direction which receives the engagement thrust force 67.
[0065] Moreover, in the thrust bearing 45 of the opposite side which does not require the engagement thrust force 67, the thing sharply smaller than the cone koro 57 is used for the cone koro 53. Furthermore, this cone koro 53 is smaller than the cone koro 241 used for the conventional example.
[0066] Thus, since the thrust bearing 45 of the direction which does not receive the engagement thrust

force 67 made the cone koro 51 small according to it, it is small and lightweight.
[0067] Drawing 4 shows the outer race 237 in the conventional example. A continuous line 69 is the inner circumference of the outer race 237 by the cone koro 241, a broken line 71 is the inner circumference of the outer race 237 when making the cone koro into a major diameter, and a broken line 73 is the inner circumference of the outer race 237 when making the cone koro into a minor diameter.
[0068] Thus, if the cone koro is made into a minor diameter, a flange 249 can make thickness 75 of a base thicker than the thickness 77 when making the cone koro into a major diameter.
[0069] So, in thrust bearing 45, since the small cone koro 53 is used, as mentioned above, by having formed the flange 65 of an outer race 49 in this thrust-bearing 45 side, sufficient thickness 79 is obtained and reinforcement of the base of a flange 65 is improving sharply.
[0070] Furthermore, since sufficient thickness 79 is obtained, by minor-diameter-izing more sharply than the periphery 83 by the side of thrust bearing 47 the periphery 81 by the side of thrust bearing 45, it is so small and the outer race 49 is lightweight.
[0071] In this way, the thrust-bearing device 1 is constituted.
[0072] As mentioned above, the whole endurance of the thrust-bearing device 1 is improving sharply by having used the large cone koro 57 for the thrust bearing 47 of the direction which receives the engagement thrust force 67.
[0073] Moreover, by having made the cone koro 53 small according to it, it is small and the thrust bearing 45 of the direction which does not receive engagement reaction force becomes lightweight.
[0074] Therefore, acquiring sufficient endurance, the thrust-bearing device 1 is lightweight and is constituted by the compact.
[0075] Moreover, by having formed in the small thrust-bearing 45 side, sufficient thickness 79 for a base was obtained and the flange 65 of an outer race 49 has obtained big reinforcement.
[0076] Moreover, since the cone koro 53 and 57 of a rolling element receives a load on a line, the thrust-bearing device 1 using the thrust bearings 45 and 47 of cone koro bearing can bear the big engagement thrust force 67, and is so high. [of endurance]
[0077] Moreover, since the big engagement thrust force 67 is applied to the drive pinion shaft 5 of the rear differential gear 3 from the directional change gear group of a bevel gear, transmitting engine driving force, the improvement effectiveness of the endurance by having made large-sized the cone koro 57 of thrust bearing 47 is very large.
[0078] Moreover, it is advantageous to have made into the small light weight thrust bearing 45 of the direction which does not receive engagement reaction force, especially when it is compact and the transmission of a car like the rear differential gear 3 is constituted lightweight.
[0079] Furthermore, that the flange 65 of an outer race 49 was strengthened has the advantageous drive pinion shaft 5 at especially the rear differential gear 3 that treats big driving force upwards and receives vibration of a car body.
[0080] Moreover, when the improvement effectiveness in endurance that they are big when the drive pinion shaft 5 and the drive pinion gear 7 consist of hypoid gears or spiral bevel gear is acquired and the thrust-bearing device 1 consists of straight bevel gear, the still bigger improvement effectiveness in endurance is acquired.
[0081] Next, drawing 5 explains the 2nd operation gestalt of this invention. The thrust-bearing device 85 of this operation gestalt is equipped with the description of claims 1, 3, 5, and 6, and is used for the rear differential gear 3 like the thrust-bearing device 1. Moreover, the upper part of drawing 5 corresponds ahead of the car which used the rear differential gear 3. In addition, the member which has not given the sign is not illustrated.
[0082] Like drawing 5 , the thrust-bearing device 85 consists of angular contact bearings 87 and 89 (thrust bearing) of the pair countered and arranged forward and backward, and these are arranged so that a mutual contact angle may become an opposite direction.
[0083] The angular contact bearing 87 by the side of before consists of retainers holding the location of an outer race 91, an inner race 93, the ball 95 (rolling element) of the minor diameter arranged among these, and each ball 95.
[0084] Moreover, the angular contact bearing 89 on the backside (drive pinion gear 7 side) consists of retainers holding the location of an outer race 91, an inner race 97, the ball 99 (rolling element) of the major diameter arranged among these, and each ball 99.
[0085] Fitting of each inner races 93 and 97 is carried out to the drive pinion shaft 5. Moreover, the outer race 91 is shared among both the angular contact bearings 87 and 89, and the flange 101 is fixed to the differential-gear carrier 15 with the bolt 63.
[0086] The flange 101 is formed in four places of a periphery, and each flange 101 is formed in the angular contact bearing 87 side of an outer race 91 like drawing 5 .

[0087] Since the engagement thrust force 67 produced in the drive pinion shaft 5 by engagement with the drive pinion gear 7 and a ring wheel 9 is applied to the angular contact bearing 89 by the side of the drive pinion gear 7, as for the ball 99, the large-sized thing is used according to the engagement thrust force 67.
[0088] Thus, since the large ball 99 was used for the angular contact bearing 89 of the direction which receives the engagement thrust force 67, compared with the conventional example, the whole endurance of the thrust-bearing device 85 is improving sharply.
[0089] Moreover, the ball 95 of a minor diameter is used for the angular contact bearing 87 of the opposite side which does not require the engagement thrust force 67 from the ball 99.
[0090] Thus, since the angular contact bearing 87 which does not receive the engagement thrust force 67 made the ball 95 the minor diameter according to it, it is small and lightweight.
[0091] Moreover, since the flange 101 of an outer race 91 was formed in the angular contact bearing 87 side using the ball 95 of a minor diameter, sufficient thickness 103 for a base is obtained and reinforcement of a flange 101 is improving sharply.
[0092] Furthermore, since sufficient thickness 103 is obtained, by minor-diameter-izing more sharply than the periphery 107 by the side of the angular contact bearing 89 the periphery 105 by the side of the angular contact bearing 87, it is so small and the outer race 91 is lightweight.
[0093] In this way, the thrust-bearing device 85 is constituted.
[0094] As mentioned above, the whole endurance of the thrust-bearing device 85 is improving sharply by having used the ball 99 of a major diameter for the angular contact bearing 89 of the direction which receives the engagement thrust force 67.
[0095] Moreover, by having made the ball 95 small according to it, it is small and the angular contact bearing 87 of the direction which does not receive engagement reaction force becomes lightweight.
[0096] Therefore, acquiring sufficient endurance, the thrust-bearing device 85 is lightweight and is constituted by the compact.
 [0097] Moreover, by having formed in the small angular contact bearing 87 side, sufficient thickness 103 for a base was obtained and the flange 101 of an outer race 91 has obtained big reinforcement.
[0098] In addition, the thrust-bearing device 85 acquires effectiveness equivalent to the thrust-bearing device 1 by having used for the rear differential gear 3.
[0099] Next, drawing 6 explains the 3rd operation gestalt of this invention. The thrust-bearing device 109 of this operation gestalt is equipped with the description of claims 1, 4, 5, and 6, and is used for the rear differential gear 3 like the thrust-bearing devices 1 and 85. Moreover, the upper part of drawing 6 corresponds ahead of the car which used the rear differential gear 3. In addition, the member which has not given the sign is not illustrated.
[0100] Like drawing 6 , the thrust-bearing device 109 consists of deep groove mold ball bearings 111 and 113 (thrust bearing) of the pair countered and arranged forward and backward.
[0101] The ball bearing 111 by the side of before consists of retainers holding the location of an outer race 115, an inner race 117, the ball 119 (rolling element) of the minor diameter arranged among these, and each ball 119.
[0102] Moreover, the ball bearing 113 on the backside (drive pinion gear 7 side) consists of retainers holding the location of an outer race 115, an inner race 121, the ball 123 (rolling element) of the major diameter arranged among these, and each ball 123.
[0103] Fitting of each inner races 117 and 121 is carried out to the drive pinion shaft 5. Moreover, the outer race 115 is shared among both the ball bearings 111 and 113, and the flange 125 is fixed to the differential-gear carrier 15 with the bolt 63.
[0104] The flange 125 is formed in four places of a periphery, and each flange 125 is formed in the ball bearing 111 side of an outer race 115 like drawing 6 .
[0105] Since the engagement thrust force 67 produced in the drive pinion shaft 5 by engagement with the drive pinion gear 7 and a ring wheel 9 is applied to the ball bearing 113 by the side of the drive pinion gear 7, as for the ball 123, the large-sized thing is used according to the engagement thrust force 67.
[0106] Thus, since the large ball 123 was used for the ball bearing 113 of the direction which receives the engagement thrust force 67, compared with the conventional example, the whole endurance of the thrust-bearing device 109 is improving sharply.
[0107] Moreover, in the ball bearing 111 of the opposite side which does not require the engagement thrust force 67, the ball 119 of a minor diameter is used from the ball 123.
[0108] Thus, since the ball bearing 111 of the direction which does not receive the engagement thrust force 67 made the ball 119 the minor diameter according to it, it is small and lightweight.
[0109] Moreover, since the flange 125 of an outer race 115 was formed in the ball bearing 111 side using the ball 119 of a minor diameter, sufficient thickness 127 for a base is obtained and reinforcement of a

flange 125 is improving sharply.
[0110] Furthermore, since sufficient thickness 127 is obtained, by minor-diameter-izing more sharply than the periphery 131 by the side of a ball bearing 113 the periphery 129 by the side of a ball bearing 111, it is so small and the outer race 115 is lightweight.
[0111] In this way, the thrust-bearing device 109 is constituted.
[0112] As mentioned above, the whole endurance of the thrust-bearing device 109 is improving sharply by having used the ball 123 of a major diameter for the ball bearing 113 of the direction which receives the engagement thrust force 67.
[0113] Moreover, by having made the ball 119 small according to it, it is small and the ball bearing 111 of the direction which does not receive engagement reaction force becomes lightweight.
[0114] Therefore, acquiring sufficient endurance, the thrust-bearing device 109 is lightweight and is constituted by the compact.
[0115] Moreover, by having formed in the small ball bearing 111 side, sufficient thickness 127 for a base was obtained and the flange 125 of an outer race 115 has obtained big reinforcement.
[0116] Moreover, since the ball bearings 111 and 113 of a deep groove mold can bear thrust loading enough, they can carry out the thrust-bearing device 109 to low cost by having used such usual ball bearings 111 and 113.
[0117] In addition, the thrust-bearing device 109 acquires effectiveness equivalent to the thrust-bearing devices 1 and 85 by having used for the rear differential gear 3.

[Translation done.]

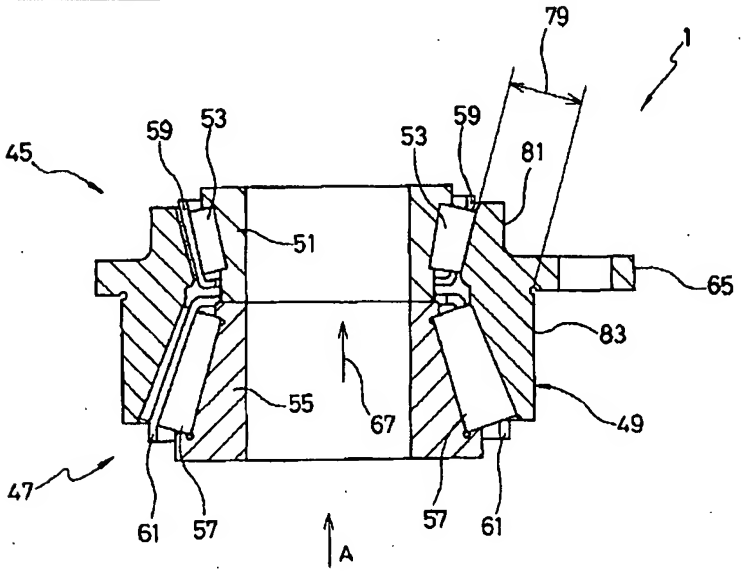
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the rear differential gear using the 1st operation gestalt of this invention.
[Drawing 2] It is drawing of longitudinal section showing the 1st operation gestalt of this invention.
[Drawing 3] It is A view Fig. of drawing 2 .
[Drawing 4] In the outer race of thrust bearing, it is the drawing in which a thick change of the path of the cone koro and a flange is shown.
[Drawing 5] It is drawing of longitudinal section showing the 2nd operation gestalt of this invention.
[Drawing 6] It is drawing of longitudinal section showing the 3rd operation gestalt of this invention.
[Drawing 7] It is the sectional view of the conventional example.
[Drawing 8] It is drawing of longitudinal section of a thrust-bearing device used for the conventional example.
[Drawing 9] It is B view Fig. of drawing 8 .
[Description of Notations]
1 85,109 Thrust-bearing device
15 Differential-Gear Carrier (Casing)
45 Cone Koro Bearing of Direction Which Does Not Receive Engagement Reaction Force (Thrust Bearing)
47 Cone Koro Bearing of Direction Which Receives Engagement Reaction Force (Thrust Bearing)
49 91,115 Outer race
51 93,117 Inner race of thrust bearing which does not receive engagement reaction force
53 Small Cone Koro Used for Cone Koro Bearing Which Does Not Receive Engagement Reaction Force (Rolling Element)
55 97,121 Inner race of thrust bearing which receives engagement reaction force
57 Large Cone Koro Used for Cone Koro Bearing Which Receives Engagement Reaction Force (Rolling Element)
65,101,125 Flange of an outer race
79,103,127 Thickness of the base of a flange
87 Angular Contact Bearing of Direction Which Does Not Receive Engagement Reaction Force (Thrust Bearing)
89 Angular Contact Bearing of Direction Which Receives Engagement Reaction Force (Thrust Bearing)
95 Ball of Minor Diameter Used for Angular Contact Bearing Which Does Not Receive Engagement Reaction Force (Rolling Element)
99 Ball of Major Diameter Used for Angular Contact Bearing Which Receives Engagement Reaction Force (Rolling Element)
111 Ball Bearing of Direction Which Does Not Receive Engagement Reaction Force (Thrust Bearing)
113 Ball Bearing of Direction Which Receives Engagement Reaction Force (Thrust Bearing)
119 Ball of Minor Diameter Used for Ball Bearing Which Does Not Receive Engagement Reaction Force (Rolling Element)
123 Ball of Major Diameter Used for Ball Bearing Which Receives Engagement Reaction Force (Rolling Element)

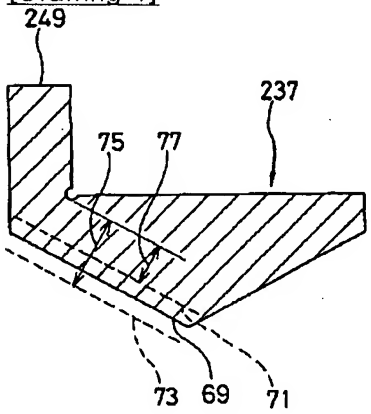
[Translation done.]

DRAWINGS

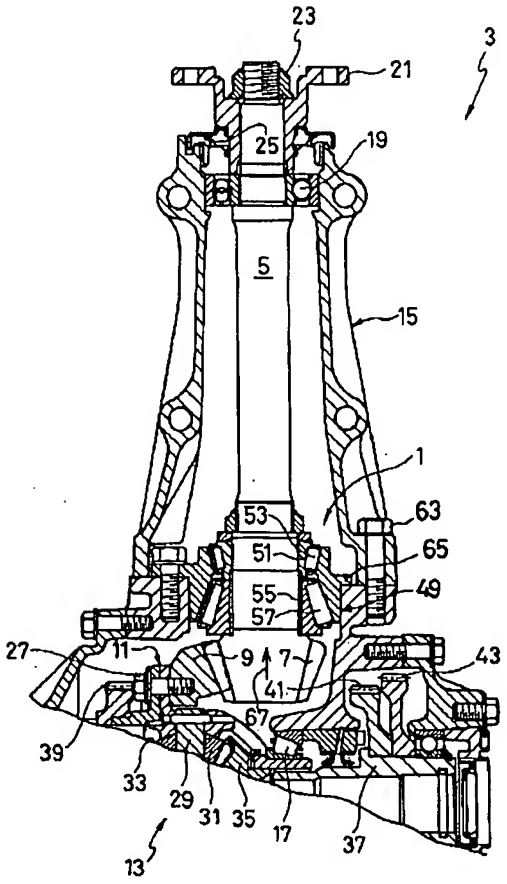
[Drawing 2]



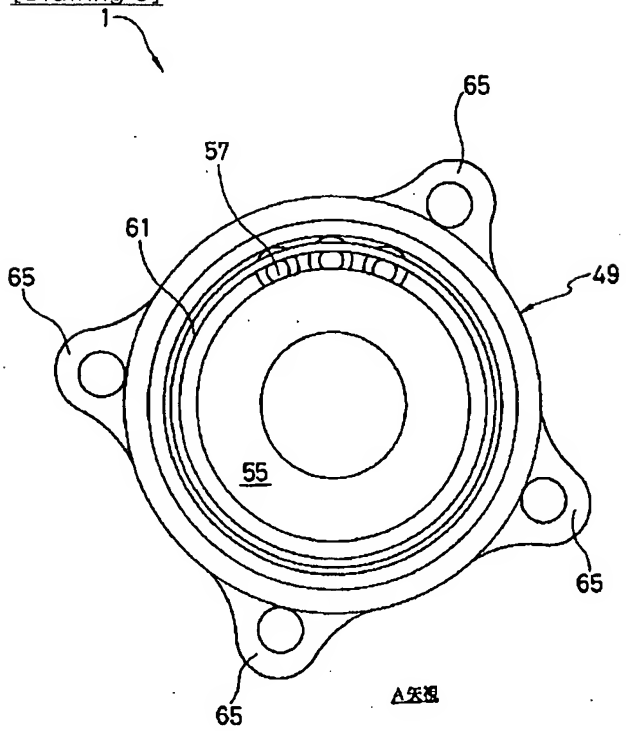
[Drawing 4]



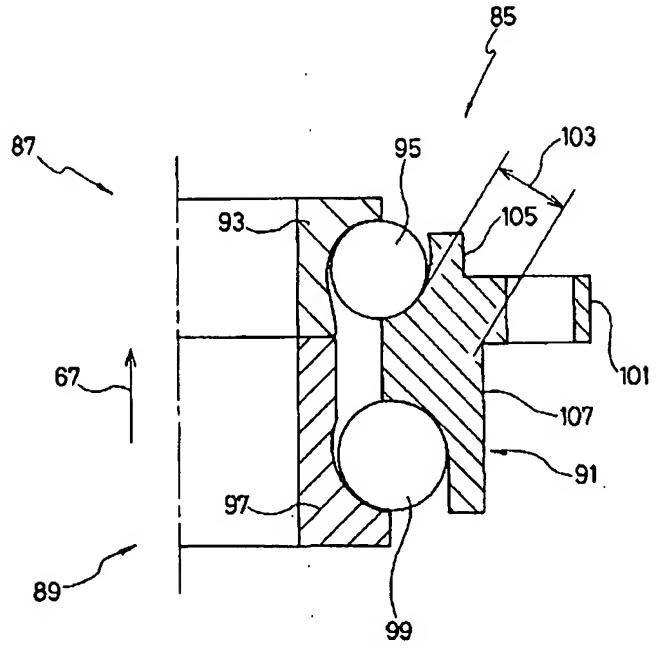
[Drawing 1]



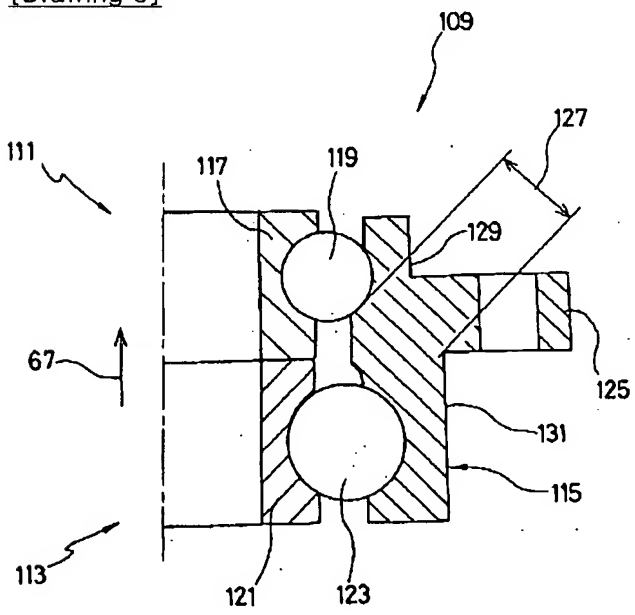
[Drawing 3]



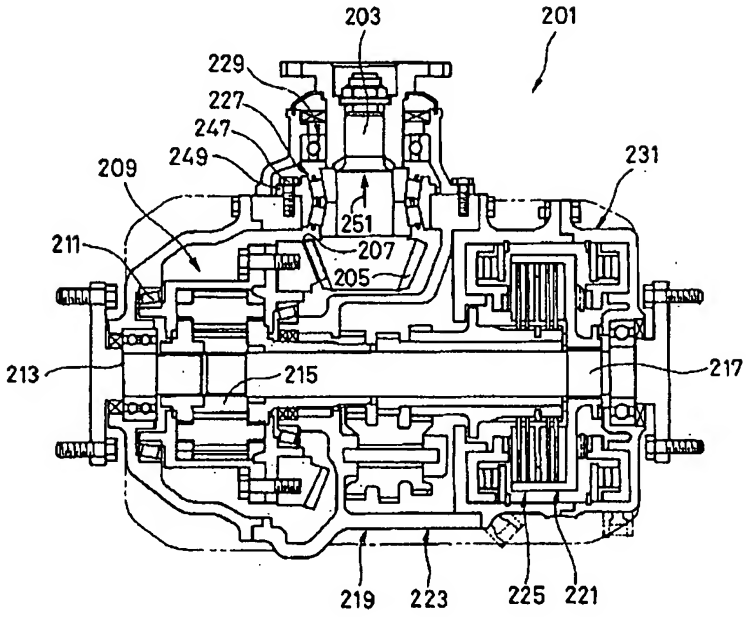
[Drawing 5]



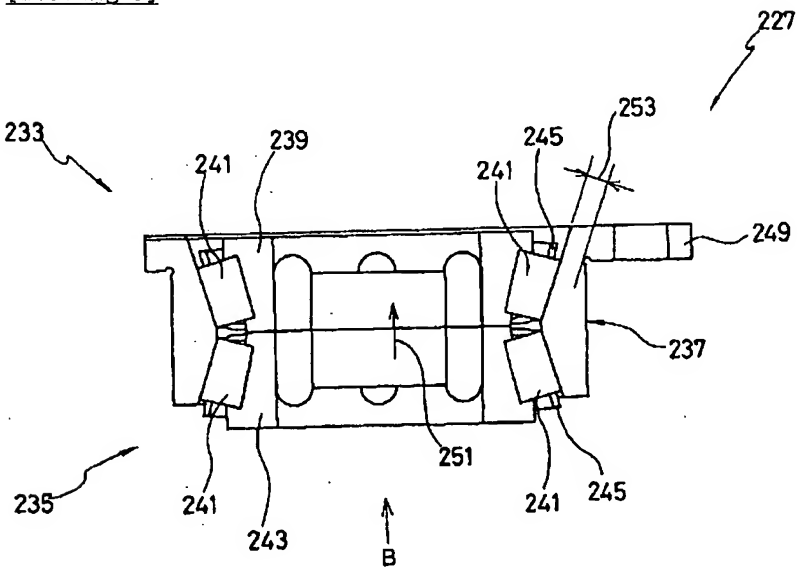
[Drawing 6]



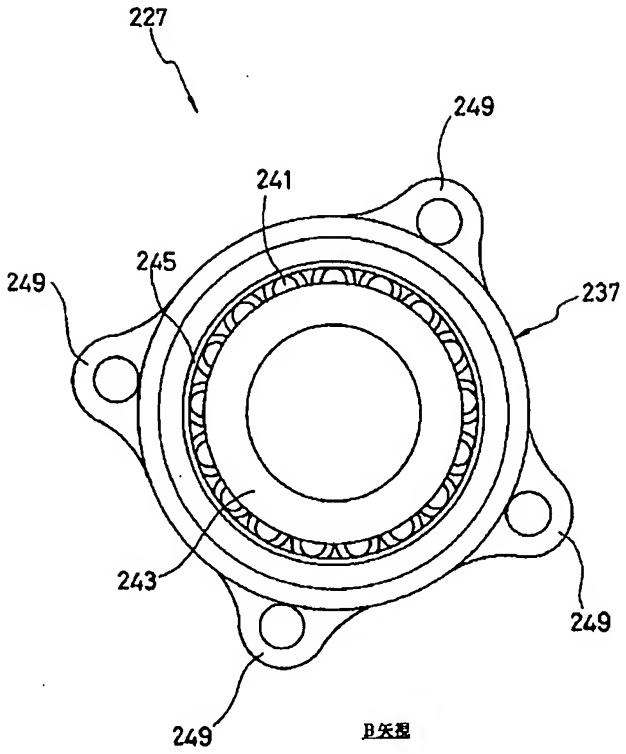
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]